

**CHIMPANZEES, CONSERVATION, AND COMMUNITY: AN ANALYSIS OF THE
JANE GOODALL INSTITUTE'S TRIANGLE APPROACH**

by
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Abstract

The illegal trafficking of great apes is a complex, multi-billion dollar industry that has resulted in dwindling wild chimpanzee populations through activities such as poaching for bushmeat and the pet trade. The Jane Goodall Institute created an integrative strategy called the Triangle Approach to combat great ape trafficking and promote the conservation of chimpanzees. This paper synthesizes information on each aspect of the Triangle Approach, as well as its successes, through data provided by the Jane Goodall Institute and interviews with staff and directors. The three strategies of the Triangle Approach are environmental education and awareness, law enforcement, and chimpanzee sanctuary work. This holistic approach has informed citizens on the illegality of wildlife trafficking and its harm to chimpanzees through leadership sessions, billboards, television shows, and radio broadcasts. Additionally, the Triangle Approach integrates the best-in-class welfare standards of chimpanzee sanctuaries that have contributed to knowledge on chimpanzee health and behavior, as well as the creation of a novel standard welfare index to ensure that chimpanzees in captivity are receiving the best possible care. Overall, this unique strategy has promoted the conservation of chimpanzees, improved captive welfare of great apes, and serves as a model for other organizations looking to effectively tackle the root causes of wildlife trafficking.

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“You cannot get through a single day without having an impact on the world around you. What you do makes a difference, and you have to decide what kind of difference you want to make.”

-Dr. Jane Goodall

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List of Abbreviations

CWI	Chimpanzee Welfare Index
GAWI	Great Ape Welfare Index
IUCN	International Union for Conservation of Nature
JGI	Jane Goodall Institute
LCRP	Liberia Chimpanzee
PASA	Pan African Sanctuary Alliance
RoC	Republic of the Congo
TCRC	Tchimpounga Chimpanzee Rehabilitation Center
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
USDA	United States Department of Agriculture

I. Introduction

Environmental crime is one of the most prominent and pressing illegal activities worldwide. The trafficking of great apes including chimpanzees is currently a multi-billion dollar worldwide industry, and is one of the three major threats to chimpanzee populations today, in addition to deforestation and disease (Stiles et al 2013). Wild chimpanzees (*Pan troglodytes*) are only found in central and west Africa, where they inhabit tropical rainforests (Figure 1). Chimpanzees have an average lifespan of 40 years, while some chimpanzees can live to 60 or more years. Their populations have dwindled to less than 300,000 individuals, classifying them as an endangered species at risk for extinction within the next 100 years. Adult chimpanzees are poached for bushmeat, while their infants are stolen and sold illegally as pets or for entertainment. This is fueled in part by food insecurity in countries across Africa, specifically the Republic of the Congo, in which lack of protein sources such as cattle lead citizens to turn to other sources of protein to supplement their diet, such as bushmeat (PASA 2020). Another driver of trade is international demand for chimpanzees as pets or entertainers, which contributes to a global syndicate system with local communities usually getting involved in illegal poaching for monetary gain. This trade has negative impacts not only on the livelihood of these primates, but on the overall biodiversity of the ecosystems they inhabit. Removing these animals from their habitats makes them incapable of fulfilling their ecological niches. Chimpanzees fulfill the specialized role of seed dispersers, as they disperse seeds that are too large for other organisms to swallow. Changes in chimpanzee populations as a result of trafficking can also negatively impact the food web.

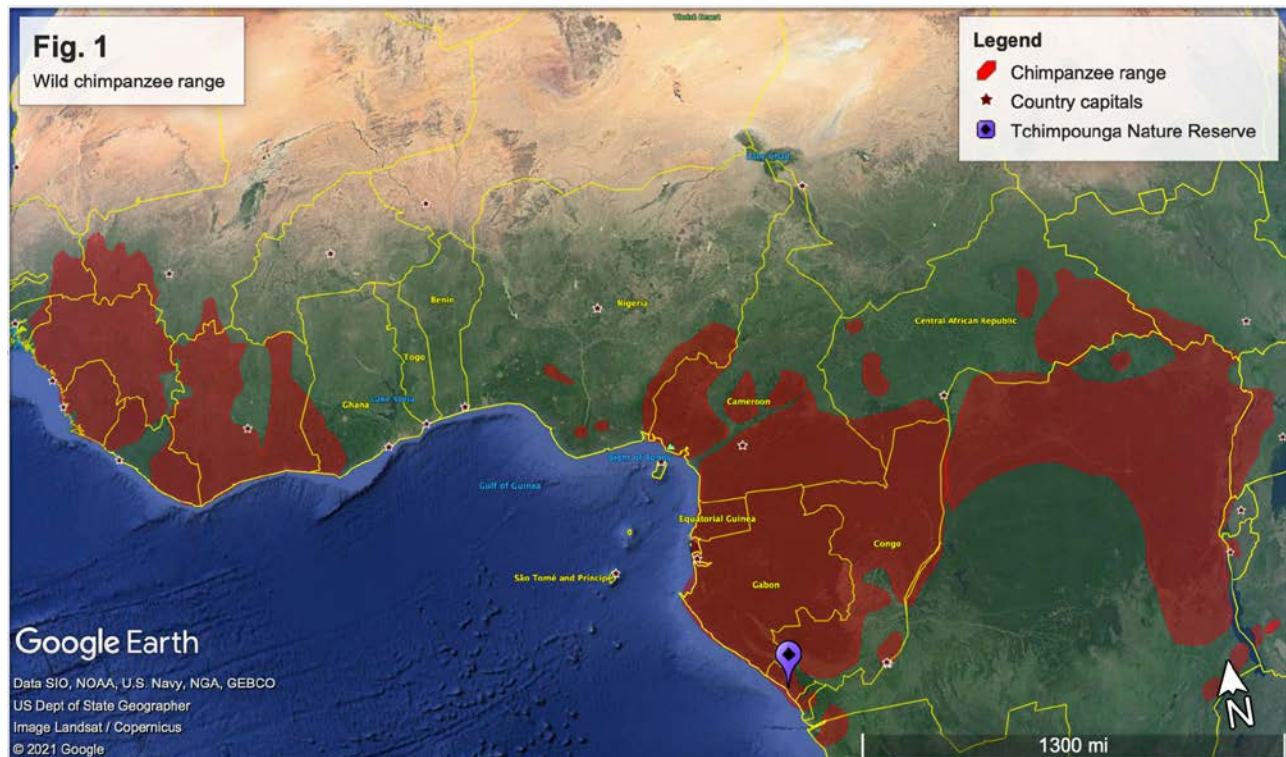


Figure 1 Chimpanzee range across Africa. Chimpanzees inhabit the following countries: Mali, Guinea, Sierra Leone, Liberia, Côte d'Ivoire, Ghana, Nigeria, Cameroon, Gabon, Republic of Congo, South Sudan, Uganda, Rwanda, Tanzania, and Burundi. The Tchimpounga Nature Reserve, managed by the Jane Goodall Institute, is designated by the purple pinpoint.

Deforestation and the loss of great ape habitat is another major threat to chimpanzee populations because it puts humans and great apes in close proximity, which is one root cause of wildlife trafficking. It is predicted that less than 10% of great ape habitat will remain by 2030 (Stiles et al 2013). This causes fragmentation of chimpanzee populations, creating another barrier that makes it difficult for them to breed. When coupled with a slow reproductive rate, this can prove challenging for chimpanzees to sustain their dwindling populations, as it takes an average of 15 years for an individual to be replaced as a breeding member of a chimpanzee group (PASA 2020). Previously, the great ape trafficking industry has been driven by environmental threats

such as deforestation, but there has been a shift in recent years to increased demand from illicit international trade as one of its main drivers.

Furthermore, the close proximity of humans and great apes makes disease transmission more likely. Populations of chimpanzees and gorillas that live in close proximity to humans have been found to have gastrointestinal *E. coli* and other bacteria that are resistant to antibiotics that can treat these bacteria in humans, but in the case of some parasites, great apes are unable to recover unless treated with antibiotics (Gilardi et al 2015). Diseases and bacteria can make great apes more susceptible to other infections, as well as environmental and social stressors. In other words, habitat destruction puts great apes at greater risk for disease transmission from humans, which has the ability to decimate populations of great apes if unable to be treated.

Approaches and Recommendations to Conservation Efforts

The United Nations Environment Program (UNEP) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) recommend focusing conservation efforts on organized trafficking, law enforcement, and consumer demand. Concentrated efforts to address organized trafficking include deeper investigations into instigators and higher-level prosecutions for those involved in wildlife trafficking. These measures would be supported by law enforcement, who would enforce changes to national and international laws regarding great apes, as well as contribute to anti-corruption efforts and databases to track trends of illegal great ape trade (Stiles et al 2013). The last piece of the UNEP and UNESCO recommendations works to deter consumer demand by eliminating the use of great apes for entertainment and advertising. Overall, their recommendations focus on upholding laws and regulations as a means of accountability for great ape trade.

The International Union for Conservation of Nature (IUCN) recommends an intervention policy, created in anticipation of events that could impact great ape populations. The purpose of intervention policy is to have strategies that can be utilized when needed, as opposed to a reactionary approach created after harm has occurred. Their policy focuses on human intervention in order to sustain great ape populations that are at risk of various pathogens. IUCN recognizes that situations can vary, so intervention policy must be applied on a case by case basis, and also be dependent on the capabilities of staff, veterinarians, and resources. There is a spectrum that ranges from conservative low risk situations that require no intervention to proactive high risk situations that require routine intervention.

Additionally, there are numerous conservation organizations that are working to eliminate drivers of the wildlife trafficking industry while advocating for chimpanzees and other great apes. One organization that is making a tangible impact is the Jane Goodall Institute (JGI), founded in 1977 by Dr. Jane Goodall with the mission of protecting and understanding chimpanzees, improving animal welfare, advancing science, and empowering the next generation. To address illegal poaching and the trafficking of chimpanzees, JGI created the Tchimpounga Chimpanzee Rehabilitation Center (TCRC) in the Republic of the Congo, a safe haven for chimpanzees that were subjected to wildlife trafficking. Since its creation in the early 1990s, TCRC has fostered well over 200 chimpanzees, and is the largest chimpanzee sanctuary in Africa. JGI uses an integration of approaches and disciplines, called the Triangle Approach, in order to ensure success of TCRC and provide the best possible care for chimpanzees. The three pillars of the Triangle Approach are sanctuaries, law enforcement, and environmental education (Figure 2). The Triangle Approach and TCRC are considered successful approaches because they not only provide care for orphaned and injured chimpanzees, but also work to address the

root causes of wildlife trafficking through integrative strategies, publicizing effective approaches, and informing global audiences of the importance of chimpanzee conservation.

There is currently a lack of literature that details each aspect of the Triangle Approach, and its influences on chimpanzees and local communities. This paper will discuss the impacts that the Triangle Approach and TCRC have on conservation and local communities through four main objectives: (1) Discuss the influence of the Triangle Approach on attitudes (public and academic) on conservation, sanctuary, captive welfare, and wildlife trafficking; (2) Describe how chimpanzee rehabilitation centers have evolved over time; (3) Analyze the impacts of rehabilitation centers on chimpanzee health and wellbeing; (4) Synthesize information on how the centers have contributed to our understanding of humans and other great apes.

II. The Triangle Approach

The Triangle Approach was effectively created by taking smaller steps in order to create a holistic solution to a large and complex problem such as chimpanzee trafficking. Researchers realized that having a concrete strategy that included sanctuary work, education, and law enforcement led to positive, lasting changes in terms of chimpanzee conservation and welfare. The integrative Triangle Approach includes three pillars, each of which will be discussed in greater detail: environmental education and awareness, law enforcement, and sanctuaries, and will look at the Republic of the Congo (RoC) as a case study for this approach.

The UN identifies the RoC as one of the main trafficking hotspots for great apes, as it hosts an estimated 10,000 chimpanzees across dense rainforests (Stiles et al 2013). Thus, JGI staff chose to focus efforts on this region in Africa, where they noticed a series of interrelated

issues when considering barriers to chimpanzee conservation. Infant chimpanzees were subjected to the pet trade while adult chimpanzees were poached for bushmeat.



Figure 2 A visual representation of the three key strategies of the Jane Goodall Institute's Triangle Approach: sanctuaries, law enforcement, and education and awareness.

Law enforcement did not feel prepared to enforce regulations regarding great ape trafficking for two main reasons: citizens were unaware of the illegality of chimpanzee trafficking, and that there was no safe place to bring confiscated chimpanzees. To address this, JGI began with an education program in the RoC to educate citizens on the illegality and harmful impacts of wildlife trafficking. Once citizens were informed of local and international laws, JGI collaborated with local law enforcement as well as other NGOs to provide assistance on the front lines enforcing these laws. Once laws began being enforced, law enforcement were able to confiscate trafficked chimpanzees and bring them to JGI's chimpanzee sanctuary.

III. Education and Awareness

Environmental education, one strategy of the Triangle Approach, inspires citizens and stakeholders to live sustainably. Providing youth (and adults) with a sound education has numerous long-term benefits, such as greater economic growth and improved livelihoods, and can also lessen the effects of poverty when women are given access to educational opportunities (Mshoro). JGI has implemented several measures to educate citizens on wildlife trafficking and promote environmental awareness through billboard campaigns, television programs, and radio broadcasts.

Environmental Education and Improved Livelihoods

It is estimated that wildlife sanctuaries across Africa educate over 500,000 people locally on the importance of wildlife conservation (PASA 2020). Programs in schools not only educate youth on conservation matters, but also cultivate respect and stewardship towards the environment - another important initiative that inspires the world's future conservation leaders. Environmental education and awareness also leads to informed citizens taking more active roles towards conservation in their communities. A citizen might be more likely to speak out and report someone who is illegally keeping a pet chimpanzee than they would be had environmental education and awareness not been in place (Cohen-Brown 2016). Dr. Rebeca Atencia, the Executive Director of the Jane Goodall Institute in the RoC, recalls a time where citizens saw mandrills in distress and felt inclined to help, so they reached out to JGI because they knew that local staff were available as a resource for helping great apes in need (Atencia per comms 2021). This demonstrates the tangible impact that environmental education, as well as community-based conservation and connections, had on the welfare of great apes.

Moreover, education has the potential to increase economic growth while decreasing poverty through improving livelihoods (Mshoro). Introducing new livelihoods, such as staffing sanctuary caretakers, can create a shift away from extractive occupations like selling bushmeat and towards sustainable livelihoods. Wildlife centers across Africa employ over 500 people, and generate over 5 million USD annually for local economies (PASA 2020). JGI developed the Triangle Approach with local communities in mind, ensuring to gain an understanding of each community's needs, so that a personalized plan was created to help serve that community. This led to an array of diverse projects, such as building schools and health centers, that directly benefited local communities and addressed their resource limitations and needs.

Billboard Campaign

As an additional measure of environmental education, JGI installed billboards in Uganda, Tanzania, and the RoC with messages about conservation in French and local languages. The purpose of the billboards was to contribute to public knowledge on wildlife trafficking, and educated readers of the consequences of engaging in illegal wildlife trafficking and encouraged citizens to protect these at-risk animals (Figure 3). There are currently 57 billboards focused on raising awareness that are located across the RoC in densely populated areas (“Tchimpounga”).



Figure 3 Photograph of community members reading a billboard for JGI’s billboard campaign in the Republic of the Congo. The billboard visually depicts the repercussions of great ape trafficking, and includes a hotline for community members to report cases of great apes in distress. Image credit: Fernando Turmo, JGI.

Television and Radio Broadcasts

Super Kodo is a television program created as an educational tool to target youth. The series follows a boy named Kodo who uses superpowers to protect forests and its inhabitants, inspiring an appreciation for the natural world. The program has the potential to reach up to 100 million viewers, and is broadcast in several languages in order to reach a wider audience (Project Television Broadcast). New episodes are still being produced and aired nationally across the RoC.

JGI also saw the merit in using radio broadcasts to spread messages of conservation and environmental stewardship. Radio broadcasting allows information to be presented to larger groups of people, and was a supplement to other initiatives such as the billboard campaigns because they could reach citizens in areas with low rates of literacy. There are currently no

ongoing broadcasts, but JGI has used this method in the RoC in the past to address bushmeat trafficking.

IV. Law Enforcement

Law enforcement is the second strategy in the Triangle Approach to address root causes of chimpanzee trafficking. The role of officers and community members on the ground is crucial for protecting chimpanzees and removing them from unsafe situations such as the illegal pet trade. Collaborating with local law enforcement had two initial obstacles: citizens were largely unaware of the laws surrounding poaching and trafficking, which made them challenging to enforce, and law enforcement had no place to bring confiscated chimpanzees prior to the creation of local sanctuaries.

With the support of citizens who report cases of chimpanzees they see in perilous situations, law enforcement can better enforce and uphold laws regarding wildlife trafficking (Cohen-Brown 2016). The measured impacts of collaboration with law enforcement are discussed in Section VI. In addition to help from officers and community members on the ground in the RoC, JGI has explored other means to tackle the root causes of great ape trafficking.

Preventing chimpanzees and other great apes from being transported from their native countries and sold in other areas is a challenge to wildlife conservationists. One common way that great apes are smuggled is via plane. Smugglers utilize the large number of air strips in the African bush, as well as smaller airports, to transport great apes and bypass customs officials (Stiles et al 2013). Conservationists needed to find more tools to put an end to wildlife trafficking, so JGI began using trained sniffer dogs as another strategy to protect chimpanzees. Trained sniffer dogs patrolled the entry points at TCRC with their handlers in order to detect

arms, ammunition, or endangered species typically targeted for international trade (Kilroy 2020). In March 2021, JGI in the RoC began using this canine detection team in Conkouati-Douli National Park, Dimonika Biosphere Reserve, and at Baskouilou Riverport (Atencia per comms 2021). JGI hopes to implement this sniffer dog strategy in other locations such as airports in order to prevent chimpanzees from being taken across borders. This strategy, in addition to tracking software that keeps records of vehicles that enter and exit TCRC, allows JGI to continue to make positive strides towards chimpanzee welfare. In the span of several months in 2019, sniffer dogs and rangers detected 135 wood boards, 23 snares, four machetes, as well as two poacher camps (Kilroy 2020). This new measure is one of the many pieces of the Triangle Approach that make it unique- innovative strategies, support from local law enforcement, and community members are integral to the success of chimpanzee conservation.

V. Great Ape Welfare

A. Metrics for Evaluating Great Ape Welfare

This section discusses the evolution of metrics used to evaluate physical and emotional wellness in great apes. Up until recently, great apes kept in captive zoo enclosures were not provided any baseline standard of care, which led to variations of welfare dependent on resources and training. Dr. Goodall influenced the understanding of emotional and social wellness through her studies on chimpanzees, asserting that great apes have very specific needs that need to be met in a captive environment, and thus require a certain standard of care. The Great Ape Welfare Index (GAWI), designed by Dr. Amanda Fernie in 2008, proposed a universal standard for great apes in captivity. The Chimpanzee Welfare Index (CWI), based on the GAWI, was developed by JGI's own Dr. Rebeca Atencia, executive director at JGI (RoC)

and head veterinarian/manager of Tchimpounga sanctuary. The CWI is a metric created specifically for chimpanzees in captivity.

Great Ape Welfare Index

Before the GAWI, there was little to no structure that focused on great ape wellbeing, especially for great apes that were kept in captive environments. Influenced in part by Dr. Goodall's insights, Dr. Fernie created a metric to determine how great apes could thrive in captivity and have their specific needs met. When developing the GAWI, Dr. Fernie observed abnormal behaviors exhibited only by great apes in captivity, such as ear covering and regurgitating and re-ingesting food, in order to gain an understanding of environmental stressors that led to these unique behaviors (Fernie 2008). She also investigated the veterinary procedures and infrastructure of captive environments such as zoos in order to develop a uniform standard that could be applied to determine great ape welfare across different captive populations. The specific attributes of the GAWI were created based on a literature review, as well as input from 7 groups of stakeholders: zoo management staff, zoo keepers, zoo education staff, great ape research colony technicians and managers, veterinarians, animal welfare organization representatives and scientists studying great apes (Fernie 2008). This research resulted in the GAWI, a compilation of environmental features that can be critical for maintaining a high standard of welfare in captive great apes. The criteria of the CWI are shown in Table 1.

Chimpanzee Welfare Index

An important aspect of providing the best possible care for chimpanzees is to focus on their behavioral, social, and physical health. This can be evaluated through the CWI, created by Dr. Rebeca Atencia. Dr. Atencia notes that there were other tools to evaluate chimpanzee

welfare, but the CWI is the only methodology that integrates numerous indicators, which is one factor that makes the CWI unique. It is a set of 17 criteria that evaluate a chimpanzee's welfare and wellness over time, and was created specifically for chimpanzees in captivity. Each chimpanzee is evaluated through the lens of the CWI, and given an individualized care plan based on their CWI scores for each criteria.

There are four categories within the CWI, each with several subcategories that receive their own weighted score that are then converted into a percentage. A CWI score of 80% or greater falls into the Very Good category, 50-80% indicates Good health, 35-50% qualifies as Medium health, while 35-25% is Poor health, and a CWI score of 25% or less falls into the Bad category. Basic factors, such as access to food, are typically met when a chimpanzee arrives at a sanctuary, and will register as the maximum threshold for that category of the CWI. For example, within the Duration of Feeding category, feeding duration that is long enough for dominant and subordinate chimpanzees to be satiated without competition for resources will receive the highest score, while a short feeding duration where chimpanzees must compete for food and water will receive the lowest score for that category.

When the CWI was first being implemented in TCRC, a chimpanzee's CWI score was evaluated every 6 months; it is now evaluated once a year. Dr. Atencia has always seen an increase of a chimpanzee's CWI score over time after arriving at a sanctuary. Chimpanzees at TCRC in 2020 had an average CWI score of 93% or greater, which increased to an average score of 97% as of February 2021.

The CWI, first tested in TCRC, has been utilized in several sanctuaries, with three more sanctuaries, the Chimpanzee Conservation Center, HELP Congo, and Tacogama, scheduled to implement this index in the future. There was a previous version of the CWI that was less

objective and more difficult to be universally applied than the current version. To address this, Dr. Atencia and her colleagues created a committee of researchers from several sanctuaries to create a new version of the welfare index to use in sanctuaries and in zoos. Dr. Atencia has also catalogued illustrations and images so the CWI can be understood across different languages, as well as help with diagnoses. This is a prime example of a non-invasive technique that can be used to evaluate chimpanzee welfare.

DIET	SOCIAL ENVIRONMENT	PHYSICAL ENVIRONMENT	MANAGEMENT
Food Item Diversity	Group Size	Enclosure Appearance	Enclosure Plants
Feeding Interval	Structures Provided for Avoidance	Access to Enclosure Furnishings	Outdoor Enclosure Availability
Duration of Feeding	Social Structure	Enclosure Size	Staff Qualifications
	Competition with Others	Provided Enrichment	
		Enclosure Temperature	
		Lighting Condition	
		Control Over Environment	

Table 1 The 17 criteria under each of the four categories of the Chimpanzee Welfare Index, whose categories are very similar to the Great Ape Welfare Index. Under the CWI, each criteria is weighted differently, then converted into an overall percentage score.

Dr. Atencia and fellow researchers are working on creating more test indicators to further develop the CWI and track chimpanzee welfare. This is a lengthy process, as each factor needs to be validated by other researchers before being officially included in the CWI, and it can take up

to two years for new metrics to be validated. There currently are no aspects of the CWI that can be applied to wild populations, due to the strong focus on animal husbandry, and the desire to evaluate chimpanzees with non-invasive techniques. However, this could lead to opportunities for the CWI to be applied to chimpanzees in other captive areas such as zoos. Today, with the legal trade of great apes dwindling, it is not uncommon for zoos to exchange great apes for breeding purposes rather than buying and selling them (Stiles et al 2013). Applying the CWI for captive chimpanzee populations in zoos would further improve chimpanzee welfare.

Chimpanzee Welfare in the United States

When the United States of America's National Institutes of Health decided to stop biomedical laboratory research on chimpanzees in 2015, there were over 1,000 chimpanzees that had to be accounted for (Collins 2015). This influx of former research chimpanzees were brought to seven chimpanzee sanctuaries in the United States, all of which aim to provide a standard of care for these vulnerable chimpanzees. Steve Ross, the Director of great ape study and conservation at the Chicago Lincoln Park Zoo, and friend/partner to the Jane Goodall Institute, proposed a metric for assessing captive chimpanzee welfare in sanctuaries to address any gaps that the United States Department of Agriculture's (USDA) Animal and Plant Health Inspection Service fails to include. Ross' tool contains three categories: social, space, and programs, that are not unlike that of the GAWI and CWI (Grimm 2020). Ross' metric has been welcomed by chimpanzee sanctuaries in the United States, as it was described as being more scientific than other federal standards. For example, a staff member at one of the United States' chimpanzee sanctuaries noted that a USDA standard is to provide clean bedding to chimpanzees, while Ross' standard focuses on the type and amount of bedding to further ensure that chimpanzees are

receiving adequate care (Grimm 2020). The state of chimpanzee sanctuaries in the United States will continue to evolve as their relationship to chimpanzee welfare fluctuates, demonstrating how a universal standard such as the CWI can be beneficial.

B. Sanctuaries

Pan African Sanctuary Alliance

Sanctuaries are an integral aspect of great ape conservation, as they provide a safe location for law enforcement to bring confiscated chimpanzees that were injured or orphaned. Great ape sanctuaries across Africa saw the benefit of forming a network of sanctuaries to exchange resources and information, which led to the creation of the Pan African Sanctuary Alliance (PASA) in 2000. JGI's Tchimpounga Chimpanzee Rehabilitation Center is a member of PASA, the coalition of 23 organizations across 13 countries in Africa that are dedicated to the conservation of chimpanzees and other great apes. Currently, PASA organizations care for over 3,000 great apes and monkeys (PASA 2020). Although these 23 sanctuary sites are located all throughout Africa, the RoC has the greatest number of sanctuaries, with 16 of the 23 sanctuaries providing lifelong care for chimpanzees (PASA 2020).

Sanctuaries affiliated with PASA receive numerous benefits. They can be certified through PASA's accreditation program for sanctuaries that have demonstrated a high standard of care for chimpanzees and other primates, as well as receive support in the form of financial contributions and veterinary resources. Financial contributions from donors is the main way that PASA supports sanctuaries, in addition to providing resources to ensure proper veterinary care.

Similar to JGI, PASA saw the value that connection with local communities and law enforcement can bring for great ape conservation. PASA encouraged discourse by holding

conferences to address the current state and future of wildlife trafficking where PASA members were able to connect with government officials and local community members alike. PASA promoted forming these relationships by working with sanctuaries to integrate collaboration with law enforcement and community members into their strategic plans. All of these actions contribute to greater welfare for great apes, as these organizations can benefit from PASA's resources, whether that be financially or tangibly.

Response to COVID-19

Chimpanzees are human's closest living relatives, sharing almost 99% of our DNA, which makes them vulnerable to human pathogens, and vice versa. Chimpanzees, gorillas, and bonobos are all able to contract COVID-19 from humans, motivating sanctuaries to adapt in order to minimize the risk of transmission. Many sanctuaries experienced similar situations during Ebola outbreaks in 2014 and 2018, and were able to look to previous protocols for protective measures to mitigate transmission between human sanctuary staff and primate residents (PASA 2020). The most successful measure to prevent disease transmission was the implementation of personal protective equipment such as face masks and gloves when coming in close contact with chimpanzees.

Sanctuaries faced financial repercussions and decreased staffing as a result from the pandemic. Sanctuaries that allowed visitors as a means of generating income were financially impacted from this loss of revenue, as many had to close their doors to visitors as a safety precaution. Additionally, these limited operations included decreasing the number of volunteers in order to further protect great apes. Because great apes in sanctuaries need 24 hour care, essential sanctuary staff devoted their time to staying at sanctuaries to compensate for duties

usually fulfilled by volunteers, and to ensure that great apes were able to receive the care they need and deserve. Sanctuaries were resilient throughout the pandemic, and no PASA- affiliated sanctuaries were forced to cease essential operations because of COVID-19, demonstrating their dedication to great ape welfare. The Jane Goodall Institute’s fundraising efforts in part (through a match campaign) helped to support several of these sanctuaries during these hardships including Chimp Eden (South Africa), Ngamba Island (Uganda), Lwiro (Democratic Republic of the Congo), as well as J.A.C.K (Jeunes Animaux Confisques au Katanga (Democratic Republic of the Congo), Sweetwaters (Kenya), Tacugama (Sierra Leone), Sanaga-Yong (Cameroon), and Limbe (Cameroon).

Tchimpounga Chimpanzee Rehabilitation Center

The Tchimpounga Chimpanzee Rehabilitation Center (TCRC), established in 1992, was created by JGI in conjunction with the RoC government, and is the largest chimpanzee sanctuary in Africa (“Tchimpounga”). It is located within the Tchimpounga Nature Reserve near Pointe Noire in the RoC (Figure 4). Chimpanzees confiscated from wildlife trafficking are brought to TCRC for a second chance - over 200 chimpanzees have been brought to TCRC since its inception and have been supported by over 50 staff members (“Tchimpounga”). In 2018, JGI allocated over \$12 million USD towards animal welfare and conservation to ensure that chimpanzee residents at TCRC were receiving the best possible care (JGI Annual Report 2018).



Figure 4. Map of the Tchimpounga Nature Reserve managed by the Jane Goodall Institute, which includes one area within the Tchimpounga Chimpanzee Rehabilitation Center (TCRC), and three semi-free range islands managed by JGI: Tchibebe Island, Tchindzoulou Island, and Ngombe Island, all surrounded by the Kouilou River. The main sanctuary at TCRC is not shown here. Image courtesy of JGI USA.

There is no universal approach when new chimpanzees are brought to TCRC, as each chimpanzee has their own needs and temperament, and introducing them to established groups influences the social hierarchy and dominance. TCRC was designed with this in mind, as areas within the facility are connected by sliding doors that make transitions between areas easy for chimpanzees and their caretakers (Turmo 2017).

Each morning, JGI staff check the 3km of fencing that surround TCRC for tampering before releasing chimpanzees from their dormitories into their large enclosures (Jane Goodall Institute USA 2016). Enrichment tools such as hammocks are also inspected for damages.

The physical wellness of all chimpanzees is evaluated each morning, and any chimpanzee who has a body temperature of over 100F is reported and monitored (Jane Goodall Institute USA

2016). Measures such as temperature checks allow JGI staff to effectively monitor the health of a large number of chimpanzees, and continue to provide the best possible care.

After a wellness check, a chimpanzee's day at TCRC varies based on their age class. There are eight groups within the Tchimpounga Nature Reserve, and chimpanzees in Groups 1 and 2 make up the oldest groups at TCRC (Table 2). They are let out into spacious enclosures that allow them to socialize and play in semi-free range habitat, free from the threats of wildlife trafficking. Each group also has their own forms of enrichment. For example, Group 1 has their food tossed over a fence, while Group 2 has their food scattered about the enclosure (Jane Goodall Institute USA 2016). In the evenings, the last meal of the day is scattered about their bedding in their dormitories (Jane Goodall Institute USA 2016). They have physical wellness checks again, and any minor injuries like cuts are attended to. They are given soy porridge one final time before they go to rest in their beds, which are composed of hay that is changed out daily (Jane Goodall Institute USA 2016). Over 100 of the chimpanzees at Tchimpounga have been transferred to the larger, more natural enclosures on sanctuary islands also maintained by JGI where they live in integrated groups. The islands managed by JGI and the impacts of reintroduction to the wild are discussed in a later section.

The younger chimpanzees and infants have a different daily schedule that meets their own needs. These chimpanzees are escorted by caretakers for trips to forested enclosures, where they can play and grow under careful supervision of JGI staff. Chimpanzees under two years are bathed in the evenings, and sleep with their caregivers until they are secure enough to sleep with older female chimpanzees (Jane Goodall Institute USA 2016).

The dietary needs of chimpanzees also vary with age. Infant chimpanzees are given baby formula until they are approximately four years old, then they are weaned onto cow's milk until

they are 6-7 years old, and then they are offered soy porridge. About 10% of diets for older chimpanzees contain wild fruits, and are supplemented with rice and soy porridge (Jane Goodall Institute USA 2016). JGI staff is responsible for preparing additional food, as TCRC does not have access to manufactured foods, and use over 750kg of fresh produce everyday (Jane Goodall Institute USA 2016).

Health and wellness are important aspects of chimpanzee welfare. As discussed previously, all chimpanzees at TCRC undergo physical wellness checks at least once a day, and their fecal matter, urine, and samples of blood are also studied, in addition to ultrasounds and EKGs to ensure that chimpanzees remain healthy (Jane Goodall Institute USA 2016).

Female chimpanzees are also given implanted contraceptives to prevent unwanted pregnancies (Jane Goodall Institute USA 2016). Although chimpanzees are endangered species, pregnancies within sanctuaries are often unwanted because sanctuaries have a capacity dependent on space and funding. When TCRC is at capacity, JGI will transfer chimpanzees to the sanctuary islands, which have their own limits to chimpanzee populations. Additionally, these contraceptive measures are taken to prevent increases in captive populations, unless there is a plan for the mother and its baby to be a part of a reintroduction program, and to prevent inbreeding within groups (Atencia per comms 2021).

GROUP NUMBER	AGE CLASS (YEARS)	NUMBER OF CHIMPANZEES	LOCATION
1	15-30	26	TCRC
2	16-30	24	TCRC
3	9-17	30	TCRC
4	4-8	32	TCRC
5	5 or Younger	8	TCRC
6	8-25	17	Tchibebe Island
7	8-25	44	Tchindzoulou Island
8	8-25	24	Ngombe Island

Table 2 Breakdown of the demographics of each chimpanzee group at Tchimpounga Nature Reserve. Over 140 chimpanzees reside at the Tchimpounga Rehabilitation Center, while over 80 chimpanzees inhabit the three islands managed by JGI. Group 5 also includes two older female chimpanzees acting as surrogate mothers.

JGI is also responsible for managing three islands within the bounds of the greater Tchimpounga Reserve in the RoC. These islands, called Tchibebe, Tchindzoulou and Ngombe, were established in September 2012 and are home to over 80 chimpanzees (Turmo 2017). They provide chimpanzees with a more natural, forested space than TCRC, fulfilling their purpose of preparing chimpanzees for potential reintroduction to the wild via semi free range areas (Turmo 2017). The surrounding Kouilou River acts as a natural barrier to provide safety from wildlife trafficking and poaching.

Similar to chimpanzee arrival at TCRC, chimpanzees are evaluated by veterinary staff before being introduced to the islands. Chimpanzees with certain conditions such as poor heart

health are not brought to these islands, as the stress from this process can further agitate any pre-existing heart problems (Turmo 2017). Similarly, chimpanzees who display overly aggressive behavior, have psychological or physical disabilities, or chimpanzees who are of older age are also not eligible for island life, but will be provided with proper care at TCRC.

Island life is a suitable conservation option for chimpanzees and other great apes when reintroduction to the wild may not be possible due to health or behavioral conditions. While reintroduction to the wild may seem like a viable end goal for chimpanzees who enter rehabilitation centers, releasing them back into the wild can put them at risk for poaching and trafficking that causes many chimpanzees to end up at rehabilitation centers in the first place. Unless the root drivers of wildlife trafficking are mitigated, reintroduction to the wild may not be beneficial for chimpanzees. However, JGI is in the research and development phase of evaluating the process of reintroduction to the wild.

Liberia Chimpanzee Rescue and Protection

The Liberia Chimpanzee Rescue and Protection (LCRP) sanctuary is one of the newer chimpanzee sanctuaries in Africa, established in 2017 and located in the Marshal Wetlands in Liberia. LCRP sanctuary has helped over 40 chimpanzees, most of whom were brought to the sanctuary at under 5 years old, orphaned by the bushmeat trade industry (“Back to the Wild” 2018). LCRP can be examined as a case study for some primary challenges and limitations facing sanctuaries and chimpanzee conservation centers today: funding, training, and integrative approaches.

Due to its recent establishment, infrastructure at LCRP sanctuary is incomplete. Plans for creating distinct areas within the sanctuary to meet the needs of different age groups is

underway. Specifically, they plan to build a canopy habitat for chimpanzees who are younger or not ready to be integrated into forested habitats yet, a wetlands habitat where adult chimpanzees can roam in semi-free range forested areas, and greater forest corridors that will allow chimpanzees to traipse as they please (“Back to the Wild” 2018).

LCRP sanctuary, like many other wildlife sanctuaries, faces the challenge of funding to create and support the necessary infrastructure to ensure a proper standard of care for chimpanzees. Inadequate funding can prevent sanctuaries from providing the necessary, specialized care that chimpanzees require- a veterinary center alone can cost upwards of \$100,000 USD (“Back to the Wild” 2018). Funding for wildlife sanctuaries largely depends on donations and income from visitors. It can be challenging to fundraise enough money to efficiently build the necessary infrastructure, especially for a newer sanctuary such as LCRP that is not as well-known as some of the larger, more established chimpanzee sanctuaries in Africa. One way LCRP is working towards overcoming the challenge of lack of funding is through the use of celebrity ambassadors, such as actress Kate Mara, who use their social media influence to promote the work done at LCRP and aid in garnering funds for the sanctuary’s upcoming projects (“Back to the Wild” 2018).

Additionally, the sanctuary is run by a duo of untraditional conservationists. Jenny and Jimmy Desmond, the founders of the LCRP organization, were introduced to wildlife sanctuaries while backpacking in the late 1990s. They decided they wanted to pursue wildlife conservation as a new career path, so Jimmy attended veterinary school to specialize in wildlife animals, while Jenny worked for various nonprofit organizations to gain a better understanding of fundraising operations. Although the Desmonds do not have similar backgrounds compared to the trained

specialists at other chimpanzee sanctuaries, they have made commitments to providing proper care for chimpanzees and working with local community members to end wildlife trafficking.

The Desmond's hail from the United States of America, and had to overcome barriers in order to gain citizenship in Liberia. While they're still establishing the infrastructure of LCRP sanctuary, they are also establishing their network to the local community. As partners of the Jane Goodall Institute and exemplified by JGI's Triangle Approach, sanctuary success is due in part to the community members who donate their time to combatting chimpanzee trafficking. An area for growth for LCRP is to connect with local law enforcement and community members in order to effectively address wildlife trafficking in Liberia.

VI. Discussion

The Triangle Approach has been an effective strategy for chimpanzee conservation and wellbeing. It evolved due to cooperation between local law enforcement, community collaboration, and improved captive welfare standards, and has led to increased environmental awareness in citizens as well as measured benefits for wildlife conservation. Since the implementation of the Triangle Approach, the number of arrivals at the Tchimpounga Center for Rehabilitation has gone from 8-10 chimpanzees a year to closer to 1-2 or sometimes zero arrivals. Specifically, the Pointe Noire and Kouliou regions of the RoC that previously accounted for 23% of great ape confiscations have seen a drastic decrease to just one confiscation in 2020 ("Tchimpounga").

Raising awareness for the importance of wildlife conservation led to improved livelihoods and a connection to local communities that were most impacted by great ape trafficking. A 2018 survey conducted by JGI in the Democratic Republic of the Congo found that

over 200 women across 20 villages were selling bushmeat (JGI Annual Report 2018). In response to this data, JGI held workshops to empower these women through activities such as leadership trainings, networking, and alternative livelihoods that promoted sustainability. Around 65 households were able to implement sustainable livelihoods of their own, such as brick making and butchery, allowing many of them to reap greater economic benefits (JGI Annual Report 2018). Moreover, 178 women bushmeat sellers reported having a better understanding of wildlife trafficking laws after attending seminars hosted by JGI (JGI Annual Report 2018).

The fresh produce used to feed chimpanzees at TCRC is purchased from local vendors, stimulating the local economy and providing a means of livelihood for villagers that is conservation-focused and allows them to sustain their families without resorting to illegal practices such as wildlife trafficking (Jane Goodall Institute USA 2016).

Additionally, there was a marked difference in the number of chimpanzee arrivals to sanctuaries after law enforcement began enforcing trafficking laws. Prior to this, only 27 total arrests relating to great ape trafficking were made in Africa from 2005-2011, and $\frac{1}{4}$ of those arrests were not prosecuted (Stiles et al 2013). It is important to note that corruption impacts these values, as prosecutions and severity of punishment vary in degree. In the RoC, specific benefits were noticed when law enforcement began enforcing laws around 2012, most notably the large decrease in the number of chimpanzee arrivals to sanctuaries. Moreover, once people began being prosecuted for illegal activities such as trafficking, it would make news headlines, acting as an additional informational tool.

A. Research

Caring for chimpanzees in close proximity has allowed researchers such as JGI's Dr. Atencia to expand knowledge of chimpanzee health and behavior. Two studies conducted at TCRC will be highlighted in this section, on chimpanzee cardiovascular health and cooperative decision making.

Cardiovascular Health

A recent study performed by JGI staff at TCRC and in conjunction with researchers at the University of Michigan, University of New Mexico, and researchers in Uganda, evaluated certain lifestyle factors in chimpanzees and their correlation with heart health. Factors such as fatty acid levels, body weight, and body fat were observed in 75 chimpanzees at TCRC, and this data was compared against other studies that focused on chimpanzee heart health.

Previously, the only data collected on chimpanzee heart health was from populations that lived in laboratory settings, and thus experienced very different conditions than those who lived in sanctuaries that are a better representation of what wild chimpanzees might experience. For example, chimpanzees in laboratory settings have less space to move about, and often consume diets composed of processed foods. Research on these laboratory populations of chimpanzees showed that they had levels of fatty acids that increased their risk for cardiovascular disease (Cole et al 2020). In contrast, chimpanzees who live in facilities that allow for free movement time and outdoor space had lower levels, decreasing their risk for cardiovascular disease even as they continued to age (Cole et al 2020). These low risk levels are also due in part to the plant-based, natural diet that these sanctuary-residing chimpanzees consume, as well as having ample space that allows them to exercise. Correlations were also made based on socialization, as

sanctuaries such as TCRC intentionally use social integration techniques to ensure that rescued chimpanzees have companionship and communities with others.

Cooperative Decision Making

Researchers also studied cooperative decision making in 40 chimpanzees at TCRC, and their willingness to make these decisions. Chimpanzees were presented with three tasks that related to resource donation, helping others, and punishment. In the resource donation tasks, chimpanzees chose between keeping a food item for themselves, or providing themselves and a human with food. Researchers found that chimpanzees did not show a strong preference between sharing the food or only receiving food for themselves, even though either choice was at no cost to them, but were less likely to share food as time went on (Rosati et al 2018).

For the helping task, chimpanzees were presented with the option to retrieve an item for a human who was actively reaching for it. In this experiment, one human took a stick from another human and tossed it away from them, towards the chimpanzee. Researchers found that chimpanzees would often give the stick back to the first human when the human vocalized and demonstrated their desire to have the stick, but rarely retrieved the stick when the human did not exhibit a desire for the stick, indicating that tasks related to object retrieval were socially motivated (Rosati et al 2018).

The punishment task had researchers steal a tray of bananas from a chimpanzee and place the tray on a table, then provided the chimpanzee with the ability to pull a string and remove the table leg, thus punishing the apparent thief of the action. In this experiment, chimpanzees often sought punishment for the thief, demonstrating their willingness to seek retribution for other's actions (Rosati et al 2018). These various experiments allowed researchers to find that

chimpanzees made prosocial, cooperative choices faster than they made selfish choices (Rosati et al 2018).

These studies on cardiovascular health and cooperative behavior are two of many examples of innovative research that is performed at TCRC. A benefit of TCRC is a monitored population of chimpanzees that can be studied in order to better understand human's closest living relatives.

B. Welfare

Sanctuaries, not typically included in conservationist thought, have the ability to make lifelong impacts on great apes in need. JGI has worked to externally share the positive impacts of TCRC, which has helped global audiences understand more about illegal wildlife crime, through campaigns like #4EverWild and coalitions like 'End Wildlife Crime,' as well as the importance of sanctuary work in terms of conservation and welfare. TCRC is a successful blueprint for other sanctuaries to follow, as it provides the best possible care for its chimpanzee residents, as well as holds strong relationships with community members to help combat wildlife trafficking. Each chimpanzee that has been supported at TCRC has their own story, two of which are highlighted in this section: George and Wounda.

George's Story

George arrived at TCRC as a baby after being confiscated from the illegal pet trade. At TCRC, he received veterinary care for parasites, and was able to form a close bond with professional caretaker Chantal. Because of the trust built between the two, Chantal acts as a surrogate mother to George, helping him recognize potential threats and dangers through

vocalizations and gestures, and properly scolding him as a mother would. The resources and support that TCRC provides will help George grow, and potentially transition to forested islands or even be reintroduced to the wild.

Wounda's Story

Wounda, another chimpanzee at TCRC, has a similar story of success. She was transferred to TCRC from another sanctuary in Congo and received intensive veterinary care, including the first known chimpanzee-to-chimpanzee blood transfusion in Africa (Sullivan 2017). After extensive treatment, she flourished and has become an alpha female, later giving birth to a chimpanzee named Hope. Upon release onto Tchindzoulou Island, Wounda showed her appreciation by embracing Dr. Goodall (*JGI does not endorse handling or close proximity to wildlife. This represents a sanctuary environment.*). Without the help of JGI staff at TCRC, Wounda could have been another victim of the bushmeat trade. She and George are two of many examples that demonstrate the high quality of individualized care that each rescued chimpanzee receives at TCRC.

VII. Conclusion

Even with extensive new knowledge and a far better understanding of the ins and outs of wildlife trafficking, chimpanzee populations are still at risk, remaining imperiled from threats like wildlife crime, deforestation, and disease. JGI's Triangle Approach strategy works towards ending one of those primary threats: chimpanzee trafficking. Four objectives were posed at the beginning of this paper: (1) Discuss the influence of the Triangle Approach on attitudes (public and academic) on conservation, sanctuary, captive welfare, and wildlife trafficking; (2) Describe how chimpanzee rehabilitation centers have evolved over time; (3) Analyze the impacts of

rehabilitation centers on chimpanzee health and wellbeing; (4) Synthesize information on how the centers have contributed to our understanding of humans and other great apes, that will be summarized in this section.

TCRC is one of the first chimpanzee rehabilitation centers, and the largest, in Africa. Since its establishment in the early 1990s, TCRC has given over 200 orphaned and injured chimpanzees a second chance, and is now home to over 140. The Tchimpounga Nature Reserve has expanded since its creation, now covering several forested islands in addition to TCRC that are home to chimpanzees at all stages of life. TCRC, and wildlife sanctuary approaches, are a crucial piece of the Triangle Approach for promoting chimpanzee welfare.

The CWI, created by JGI's Dr. Atencia, has greatly contributed to the field of chimpanzee captive welfare and veterinary science. Based on the GAWI, the CWI is a metric for evaluating chimpanzee welfare, allowing caregivers to create a personalized plan for each chimpanzee based on factors such as diet, physical environment, social environment, and management. Since the implementation of this metric at TCRC, Dr. Atencia has seen the CWI of every chimpanzee improve over time since their arrival at the sanctuary, demonstrating the measured impact that this approach has on chimpanzee welfare.

TCRC, as well as the other pieces of the Triangle Approach, have impacted public attitudes towards great ape conservation. TCRC and wildlife sanctuaries provide local communities with sustainable job opportunities rather than extractive ones, and can stimulate the local economy through collaborations with local vendors. Moreover, through environmental education tactics such as billboard campaigns, radio broadcasts, and television programs, local communities can be informed about the harmful practices and illegality of wildlife trafficking.

Studies at TCRC have also contributed to human's understanding of chimpanzee physiology, from cardiovascular health to behavioral decision making. Overall, the Triangle Approach is an effective strategy for combating wildlife trafficking, as it works to tackle the complex root causes of wildlife trafficking, as well as promoting the conservation of chimpanzees, and educating local communities.

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